

Occurrence of the rare genus *Microcrocis* P. Richter (Chroococcales, Cyanobacteria) in a coastal lagoon from southern Brazil

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ABSTRACT – (Occurrence of the rare genus *Microcrocis* P. Richter (Chroococcales, Cyanobacteria) in a coastal lagoon from southern Brazil). The paper records the first occurrence of the genus *Microcrocis* P. Richter (Chroococcales, Cyanobacteria), represented by *M. pulchella* (Buell) Geitler, in Brazil. The species was found in two zones, one with freshwater and the other with brackish water, of a coastal lagoon of Rio Grande do Sul State (31°15'-31°30' S and 50°54'-51°09' W). Comparison between *M. pulchella* and its most closely related species is presented. Up to now this species had occurrence records limited to freshwater systems in temperate regions. Its presence in a subtropical coastal lagoon from southernmost Brazil, either in fresh or in brackish water, broadened the knowledge of the distribution area of *M. pulchella*.

Key words - Brazil, coastal lagoon, Cyanobacteria, *Microcrocis*

RESUMO – (Ocorrência do raro gênero *Microcrocis* P. Richter (Chroococcales, Cyanobacteria) em uma lagoa costeira do Sul do Brasil). O trabalho apresenta o primeiro registro de ocorrência do gênero *Microcrocis* P. Richter (Chroococcales, Cyanobacteria), representado pela espécie *M. pulchella* (Buell) Geitler, no Brasil. A espécie foi encontrada em zona de água doce e salobra de uma lagoa costeira do Estado do Rio Grande do Sul (31°15'-31°30' S and 50°54'-51°09' W). É apresentada comparação entre *M. pulchella* e suas espécies próximas. Até o momento, a espécie apresentava registro de ocorrência limitada a ambiente de água doce de zona temperada. Sua presença em uma lagoa costeira subtropical, no extremo Sul do Brasil, tanto em água doce como salobra, amplia a área de distribuição conhecida de *M. pulchella*.

Palavras-chave - Brasil, Cyanobacteria, lagoa costeira, *Microcrocis*

Introduction

Microcrocis P. Richter was proposed by Richter (1892) based on material collected in a ditch near Leipzig (Germany), characterized essentially by its flat, tabular colonies, composed by one layer of packed cells, arranged in regular or irregular rows. Fott (1972) considered the taxonomy of *Microcrocis* species confusing, and their occurrence rather rare in comparison with the nearest genus *Merismopedia*. *Microcrocis* species were initially classified by Lagerheim (1883) as section *Holopedium* of the genus *Merismopedia*. On the other hand, in 1893, the same author elevated the section *Holopedium* to genus level. Frémy (1930) and Geitler (1932) also considered *Holopedia* as an independent genus, whereas Geitler (1942) considered it synonymous of the genus *Microcrocis*. Komárek & Anagnostidis (1999) also followed the synonymization proposed by Geitler (1942)

and considered *Microcrocis* as a member of the family Merismopediaceae, sub-family Merismopedioideae.

Komárek & Anagnostidis (1999) stated that *Microcrocis* comprises ten well defined species and listed four others that should be revised. Most species have been found in European and North American freshwater bodies. For the first time, the genus, represented by *M. pulchella* (Buell) Geitler, is recorded in a Brazilian water system. It was originally found in a lake in Minneapolis, Minnesota. Up to now, *M. geminata*, as *Holopedia geminata* Lagerheim, was the only species of *Microcrocis* reported for South America (Argentina, Tierra del Fuego) by Guarrera (1986).

The present paper registers the occurrence of *M. pulchella* specimens in “Peixe” Lagoon, a subtropical, coastal lagoon from southern Brazil. This paper aims to contribute to the taxonomy, ecology, and geographic distribution of the genus *Microcrocis*.

Material and methods

Study area – “Peixe” Lagoon is a very peculiar ecosystem, situated in the southern region of the Coastal Plain of Rio Grande do Sul State, Brazil, in a narrow zone between the Atlantic Ocean and Patos Lagoon (31°15'-31°30' S and 50°54'-

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51°09' W), 1.5 to 3 km from the ocean. It is a closed system during most part of the year, being supplied essentially by rain water and, occasionally, by the sea through a canal, which periodically connects the lagoon to the sea (figure 1). It belongs to the "Peixe" Lagoon National Park.

The lagoon is approximately 40 km long and 1 km wide. Its surface area is 43.70 km², the volume is 12.67 10⁶ m³, and the average depth is 29 cm (Schwarzbold & Schäfer 1984). During the phycoflora investigation at different sites of the lagoon, from December 1990 to December 1992, the maximum and minimum depth registered were 1 m and 15 cm, respectively; pH ranged from 6.2 to 8.4, water temperature from 21 to 26 °C, and the salinity varied at the different sites. Low salinity values (0‰-0.8‰) have only been reported in the northernmost portion of the lagoon, and in the other zones, the salinity oscillated from 14‰ to 51‰ (V.R. Werner, unpublished data). The lagoon is subject to high evaporation due to its shallowness, and during very dry periods, most of its area dries completely. The presence of grasses, inside and around the lagoon, indicates the variation of water levels (Chomenko 1981). The algal community of "Peixe" Lagoon is rich, composed essentially of diatoms and cyanobacteria.

The studied specimens were collected in December 1990 from two sites of "Peixe" Lagoon: one in a freshwater and the other in a brackish water zone. The samples were collected using a 25 µm mesh plankton net. All samples were preserved

in a 4% formaldehyde solution and incorporated to the "Prof. Dr. Alarich R. H. Schultz" Herbarium (HAS), Porto Alegre, Rio Grande do Sul State, Brazil, under the numbers 25775 and 25784. The classification system of Komárek & Anagnostidis (1999) was adopted.

Results and Discussion

Microcrocis P. Richter is characterized by developing microscopic to macroscopic, flat, tabular and mucilaginous colonies, composed of one layer of densely packed cells, sometimes forming sub-colonies; cells elongated, ellipsoidal, oval, rod-shaped or polygonal, without mucilaginous envelope, oriented with their longer axis perpendicular to the plane of the colony, irregularly arranged, sometimes disposed in perpendicular rows in young colonies; cellular division in two perpendicular planes in successive generations; cells separate and slightly shift apart from one another after division; reproduction by disintegration of colonies.

Microcrocis differs from the nearest genus *Merismopedia* by the elongated cells oriented by their longer axis perpendicular to the plane of the colony, whereas in *Merismopedia* the cells are spherical or widely elliptical, after the division they are hemispherical, and arranged with their longer axis in the colony plane. In addition, the cells are disposed in perpendicular rows forming square or rectangular colonies in *Merismopedia*, whereas in *Microcrocis* they are irregularly arranged, especially in old colonies. In several species, rows of cells are rarely formed, and the colonies usually present irregular outlines.

For the first time, the genus, represented by *M. pulchella*, is registered in a Brazilian water body. This is also the first record of the species in South America and the second in the world.

Microcrocis pulchella (Buell) Geitler in Engler & Prantl, Natürl. Pflanzenfam., 2ed., 1b:56. 1942.

Basionym: *Holopedia pulchella* Buell, Bull. Torrey bot. Club 65:385. 1938.

Figures 2-4

Colonies flat, tabular, elongated, and irregular, 72-85.8 × 50-70.6 µm, composed by many cells (ca. 300), densely and irregularly arranged; mucilage homogeneous, hyaline, diffuent; cells polygonal in apical view, elongated or oval at the periphery of the colonies, becoming hemispherical after division, 3.2-5.6 × (2-)2.3-3.6 µm; cells elongated in lateral view, 3.8-6 µm long; cell content bright blue-green, homogeneous, without aerotopes.

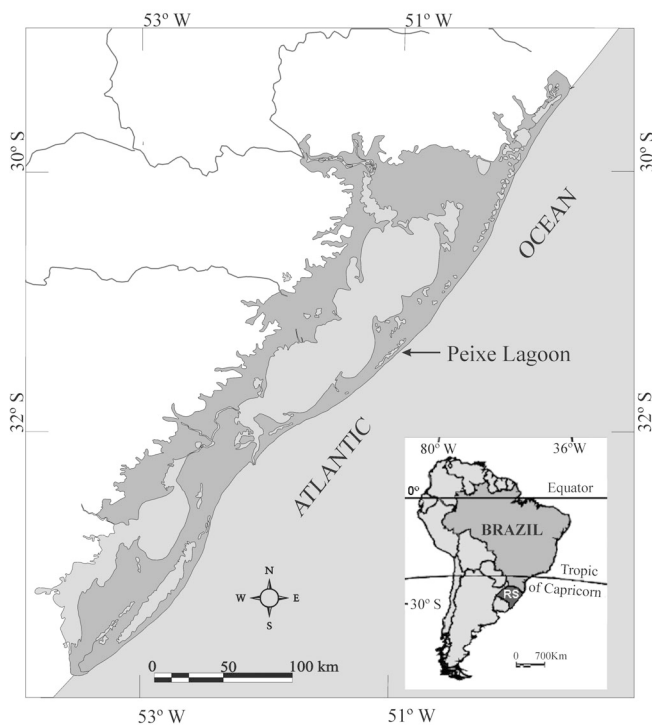
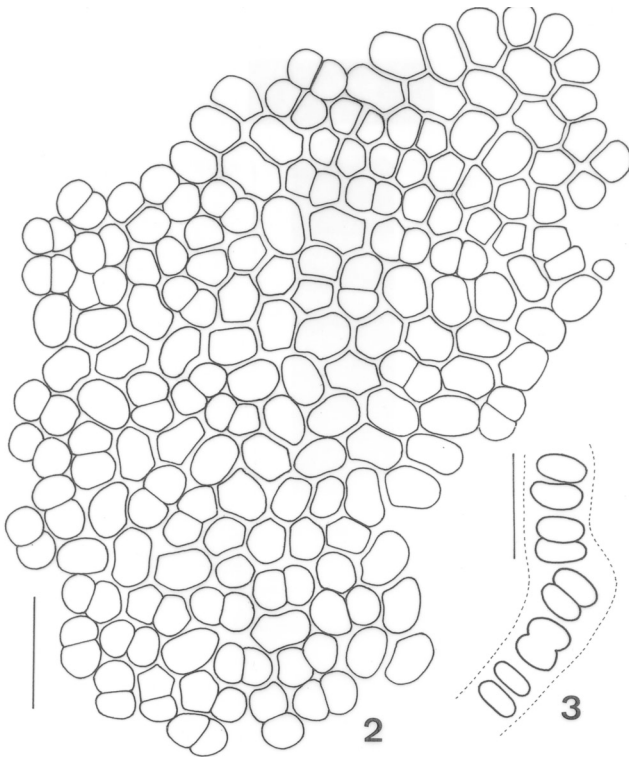


Figure 1. Map of the coastal lagoon system of Rio Grande do Sul State, Brazil, showing the "Peixe" Lagoon.



Figures 2-3. *Microcrocis pulchella* (Buell) Geitler. 2. Colony in apical view. 3. Cells in lateral view. Bars = 10 µm.

Microcrocis pulchella was originally described as *Holopedia pulchella* by Buell (1938), observed growing on mud in the inner part of a cyanobacterial mass, later floating to the surface of a deep (3-6 m) freshwater North American lake (Minneapolis, Minnesota), usually followed by the cyanobacterias *Microcrocis geminata* (Lagerheim) Geitler and *Merismopedia convoluta* Brébisson.

In "Peixe" Lagoon, it was found free-floating in the water, and also as an epiphyte of *Merismopedia convoluta* colonies, and on suspended material. Considering that the specimens were collected in this shallow lagoon (in sites with 15-40 cm depth) and with the presence of benthic algae, we assume that the colonies might have been removed from the bottom of the lagoon due to environmental factors, specially the wind.

Although physical and chemical water data were not measured when these samples were collected, we can state that *M. pulchella* occurred both in fresh and brackish water zones of "Peixe" Lagoon, based on the data obtained during other sampling at the same sites. A concentration of 14‰ was registered, however, the species was not observed in this sample.

Even though the species was originally described from a freshwater habitat, morphological and metric differences were not observed in the specimens from the brackish water zone. Thus, we can conclude that *M. pulchella* is able to grow in fresh and brackish waters. Until now, it had been recorded only from a North American lake and its occurrence in a subtropical, southernmost Brazilian ecosystem, expanded the knowledge of the distribution of *M. pulchella*.

The morphologic and metric characters of the examined specimens are in accordance with those described in Buell (1938) and Komárek & Anagnostidis (1999). Comparison of *M. pulchella* with its closest related species (table 1).

The typical polygonal cells of *M. pulchella* and their dense arrangement in the colonies resemble somehow those of *M. granulata* (Skuja) Skuja and *M. bella* (Beck-Mannagetta) Komárek & Anagnostidis. Nevertheless, the first two species have larger cells. In addition, *M. granulata* has wavy or rolled margin colonies, whereas the colonies of *M. pulchella* are flat, and *M. pulchella* differs from *M. bella* by the absence of conspicuous granules, characteristic of the latter. Besides, according to Komárek & Anagnostidis (1999), the colonies of *M. bella* have up to 90 cells, whereas the studied material presents about 300 cells.

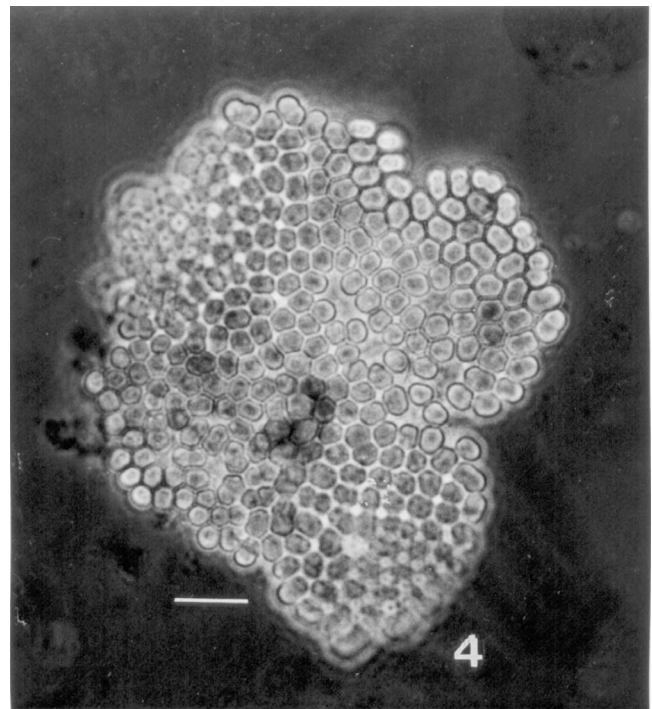


Figure 4. General view of a *Microcrocis pulchella* (Buell) Geitler colony. Bar = 10 µm.

Table 1. Comparison between *Microcrocis pulchella* and its closest related species.

	<i>M. granulata</i>	<i>M. bella</i>	<i>M. geminata</i>	<i>M. pulchella</i>
Colonies shape	flat, tabular, wavy or rolled	flat, tabular	flat, tabular, wavy or rolled	flat, tabular
Colonies size	> 200 µm diam.	> 60 µm diam.	to 3 mm diam.	50-70.6 µm diam. 72-85.8 µm long ca. 300
Cell number	many	up to 90	1,800-3,000	densely
Cell arrangement	very densely	very densely	very densely	polygonal, elongated or
Cell shape	polygonal, cylindrical, rounded or conical-rounded at the poles	polygonal, cylindrical, conical-rounded at the poles; on the extremity rounded	rod-shaped, with rounded ends	oval at the poles
Cell size (length × diam.)	6.5-8 × 3.5-4.7 µm	7 × 3.4-4 µm	12-15 × 3.4-6(-7) µm	3.2-5.6 × (2-)2.3-3.6 µm; 3.8-6 µm long, in lateral view
Cell content	blue-green, finely granular	bright blue-green granular	blue-green	bright blue-green
Habitat	freshwater: planktic, in lakes. Sweden	stagnant waters. Austria (Carinthia), Sweden (Abisko)	freshwater: benthic, metaphytic or occasionally free-floating; pools, swamps, littoral of lakes Northern temperate zones. Argentine (Tierra del Fuego)	fresh and brackish water: on mud among other algae (type locality), floating in a lake Minnesota* (Minneapolis)**: coastal lagoon Brazil (Rio Grande do Sul)**
References	Komárek & Anagnostidis (1999)	Komárek & Anagnostidis (1999)	Komárek & Anagnostidis (1999)	Buell (1938)

* = cited by Buell (1938); ** = present study.

Microcrocis pulchella also resembles *M. geminata* (Lagerheim) Geitler, especially the specimens described by Richter (1892) and identified as *M. dietelii* Richter, but in this species the cells are larger and rod-shaped with rounded ends, whereas those of *M. pulchella* are polygonal and elongated or oval near the periphery of the colony.

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